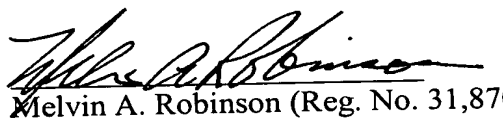
## REMARKS

The foregoing amendments to the specification and claims under Article 41 of the Patent Cooperation Treaty place the application into a form for prosecution before the U.S. Patent and Trademark Office under 35 U.S.C.§371. Accordingly, entry of these amendments before examination on the merits is hereby requested.

Respectfully submitted,



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# SPECIFICATION

## TITLE

## "DEVICE ~~FOR RECHARGING A~~AND METHOD FOR CHARGING A MEDIA TRANSPORT BELT CONVEYOR ~~AT A CONTACT WITH A BLADE~~IN A PRINTER OR COPIER"

## BACKGROUND OF THE INVENTION

### Field of the Invention

[0001] The present invention concerns a device and a method for electrical charging of a transport belt for ~~the transport of~~transporting recording media in ~~the~~a transfer printing region of an electrophotographic printer or copier device. The invention also concerns an associated blade-like contact element.

### Description of the Related Art

[0002] In electrophotographic printers or copier devices, the transfer of a toner image from an the intermediate carrier (for example a photoconductor drum or a photoconductor belt) onto a the recording medium is ~~designated~~referred to as transfer printing. The section of the printer or copier device at which the intermediate carrier and the recording medium are brought into contact with one another is ~~designated~~referred to as a transfer printing region. In the transfer printing region, the intermediate carrier (for example the generated surface of a photoconductor drum) and the recording medium move with the same speed in the same direction while the toner is transferred from the intermediate carrier onto the recording medium.

[0003] A good print image on the recording medium can only be achieved when a uniform contact is produced between the recording medium and the intermediate carrier in the transfer printing region. A good and uniform contact between the recording medium and the intermediate carrier can be achieved with the aid of an electrostatically-chargeable transport belt on which the recording media lies and, adhering to this with electrostatic forces, is transported through the transfer printing region.

[0004] A device for transfer of a toner image with the aid of an electrostatically-chargeable transport belt is shown in German Patent Document DE 102 47 368.4 (not previously published), which is incorporated by reference into the present specification. In this device, the transport belt is charged with a charge whose polarity is different than the polarity of the charge of the toner image. This electrostatic charging of the transport belt has a two-fold function: on the one hand, it effects an electrostatic attraction of the recording medium to the transport belt and thus a secure guidance of the recording medium in the transfer printing region; on the other hand, it effects the transfer of the toner image from the intermediate carrier onto the recording medium.

[0005] Similar devices with electrostatically-charge transport belts are also known from US Patent No. 5,666,622, German Patent Document DE 195 01 544 A1 and US Patent No. 5,159,392. In these three documents, the transport belt is either charged via corona arrangements (what are known as corotrons) or via contact rollers. A corotron typically comprises one or more thin, gold-coated tungsten wires whose electrical potential is ~~some~~about 1000 V relative to a grounded housing, such that the air surrounding the wires is ionized.

[0006] However, corotrons have a ~~series~~number of serious disadvantages including, for example, the ozone formation due to the high charge voltage and the relatively complicated exchange of worn-our corotron wires. Moreover, the corotron wires are easily contaminated with dust, belt abrasion particles and toner particles, which leads to an irregular charge distribution on the transport belt. Locations with a lower transport belt charge lead to a less complete transfer of the toner onto the overlying the recording medium and thus to unwanted lightening, or fading, of the print image ~~lightenings~~. The cleaning of the corotron wires is not only elaborate but also ~~represents~~subjects the wires to a significant mechanical stress ~~for these~~ and shortens their lifespan.

[0007] Contact rollers also have ~~the~~a disadvantage in that they can ~~contaminate~~become contaminated easily and thereby lead to an irregular ~~charge~~charging of the transport belt. Moreover, they can not be directly arranged in the transfer printing region

because they would interfere with the uniform arrangement of the recording medium on the intermediate carrier. Nevertheless, in order to achieve a sufficient charge of the transport belt in the transfer printing region, a certain current must flow ~~from~~at the contact point from the contact roller ~~[sic]~~ and transport belt to the transfer printing region. Therefore, the conductivity of the transport belt may not be too low, which represents a disadvantageous limitation for the selection of the transport belt material used.

## SUMMARY OF THE INVENTION

**[0008]** The present invention ~~is based on the object to specify~~provides a device and a method for charging ~~of the~~a transport belt in a printer that ~~enable~~enables a uniform charge of the transport belt in the transfer printing region and requires ~~a lesser~~less maintenance expenditure.

**[0009]** This ~~object~~ is inventively achieved via a device and a method in which a blade-like contact element is arranged transverse to the running direction of the transport belt and abutting on ~~this, via which~~the belt. The contact element transfers an electrical charge ~~is transferred~~ to the transport belt~~, and in which the~~. The blade-like contact element can be arranged on a carrier element that can be inserted into and extracted from the printer or copier.

**[0010]** Such a blade-like contact element can be arranged directly in the transfer printing region on the side of the transport belt facing away from the intermediate carrier, and therewith provides ~~for~~ a reliable, uniform electrostatic charge of the transport belt in the transfer printing region. Since the transport belt continually drags ~~along on~~against the blade-like contact element, ~~this~~the contact element is constantly cleaned. Due to the ~~removal capability~~ability of the carrier element to be removed, the ~~Blade~~blade-like ~~[sic]~~ contact element is easily ~~accessible for~~replaced during maintenance ~~tasks~~. The ~~Blade~~blade-like ~~[sic]~~ contact element is preferably fastened on the carrier element ~~such~~so that it can be detached, such that it can be easily exchanged as an expendable part. ~~Advantageous developments of the invention are specified in the further claims.~~

[0011] For better understanding of the present invention, reference is made in the following to the preferred exemplary embodiment shown in the drawings which is described using specific terminology. However, it is noted that the protective scope of the invention should not thereby be limited since such variations and further modifications to the shown device and the method as well as such further applications of the invention as they are shown therein are viewed as typical present or future specialized knowledge of a competent average man skilled in the art.

[0012]

[0013] ~~Figures show an exemplary embodiment of the invention, namely~~

## BRIEF DESCRIPTION OF THE DRAWINGS

[0014] **Figure 1** is a schematic representation of the components of an electrophotographic printer or copier ~~participating~~that are utilized in the image generation;

[0015] **Figure 2** is a perspective ~~representation~~view of a paper transport aggregate for a printer or copier in which the carrier element for the blade-like carrier element is extracted;

[0016] **Figure 3** is a perspective ~~representation~~view of the paper transport aggregate from Figure 2, in which the carrier element is inserted;

[0017] **Figure 4** is a perspective ~~representation~~view of the carrier element and of the blade-like contact element; and

[0018] **Figure 5** is a perspective ~~representation~~view of the carrier element and of the blade-like contact element from Figure 4 from another viewing direction.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] The components of an electrophotographic printer that participate in the printed image generation are schematically shown in **Figure 1**. **Figure 1** shows a photoconductor drum 10 whose peripheral surface is coated with a photosemiconductor, for

example arsenic triselenide ($As_2Se_3$). Also shown in **Figure 1** ~~is [sic] a~~are charge corotron 12 for charging of the photosemiconductor layer of the photoconductor drum 10, a character generator 14 for exposure of the photosemiconductor layer in order to generate a latent charge image on ~~said~~the photosemiconductor layer, and a developing unit 16 to develop the latent charge image with charged toner particles.

[0020] A paper transport aggregate 18 is also schematically shown in **Figure 1** by a dashed box. The paper transport aggregate 18 comprises a transport belt 20 that is directed around a first roller 22, a second roller 24, a tension roller 26 and a positioning roller 28. The transport belt 20 is driven by the first roller 22 in the direction characterized by the arrow 30. The paper transport aggregate 18 also comprises a device 32 for electrical charging of the transport belt 20 that is only schematically shown in **Figure 1**. The device 32 comprises a blade-like contact element 34 that is arranged transverse to the running direction of the transport belt 20 and abutting on this. Finally, the paper transport aggregate 18 comprises a cleaning unit 36 with an abrasion ridge 28 for abrasion of toner particles from the transport belt 20 and a toner capture reservoir 40 for capture of the abraded toner.

[0021] Finally, a cleaning unit 42 for cleaning of the photoconductor drum and a fixing unit 44 for fixing the toner image ~~toner [sic]~~ onto the paper are shown in **Figure 1**. More detailed explanations of the function of the listed elements from **Figure 1** are found in German Patent Document DE 102 47 368.4 (cited above, not previously published) and ~~should~~have not ~~be~~been repeated here.

[0022] The transport belt 20 serves for the transport of a ~~sheet~~ paper ~~[sic]~~sheet 46 (likewise shown in **Figure 1**) through the transfer printing region 48 in which the ~~sheet~~ paper ~~[sic]~~sheet 46 is pressed against the photoconductor drum 10. The transport belt 20 is charged by the device 32 with a charge that is opposite the charge of the toner particles. The electrostatic charge of the transport belt 20 provides for a secure retention of the sheet 46 on the transport belt and for transfer of the toner particles from the photoconductor drum 10 onto the sheet 46.

[0023] As is to be learned from the schematic representation of **Figure 1**, in the transfer printing region the blade-like contact wavelength 34 of the transport belt 20 contacts on the side facing away from the photoconductor drum 10 (the underside in the representation of **Figure 1**). This means that the electrical charge there is precisely transferred to the transport belt 20 at which it is required. Upon transfer of the toner from the photoconductor drum 10 onto the sheet 46, an electrical current flows from the transport belt 20 to the photoconductor drum 10. Since the contact blade 34 is arranged in the transfer printing region, this current does not have to flow in the longitudinal direction of the transport belt 20 to the transfer printing region 48.

[0024] The paper transport aggregate 18, which was shown only schematically in **Figure 1**, is shown in a perspective representation in **Figure 2**. One recognizes the transport belt 20, the first roller 22 (or, respectively, its axle), the second roller 24, the tension roller 26 (or, respectively, its axle), the positioning roller 28 and the toner capture reservoir 40 described in connection with **Figure 1**. The device 32 for electrical charging of the transport belt 20 is also shown. The device 32 comprises a carrier element 48 made of plastic, to which carrier element 48 the blade-like contact element 34 is attached.

[0025] The paper transport aggregate 18 has a recess 50 into which the carrier element 48, with its attached contact element 34, can be inserted. The paper transport aggregate 18 with inserted carrier elements ~~[sic]~~ 48 is shown in **Figure 3**.

[0026] As is to be learned from **Figures 2** and **3**, the carrier element 48 has an engagement section 52 at which it can be gripped upon insertion into or, respectively, upon extraction from the paper transport aggregate 18. A detent hook 54 (see **Figure 2**) is integrated into the engagement section 52, which detent hook 54 is pre-stressed in a blocking position in which it engages in a matching groove 55 in the recess 50 when the carrier element 48 is completely inserted into the paper transport aggregate 18. The detent hook 54 can be raised from its blocking position via activation of a release button counter to the pre-stress such that the carrier elements ~~[sic]~~ 48 can be extracted from the paper transport aggregate 18.

[0027] A first plug element 58 (~~Fig. 2, Fig.~~see **Figure 2** and **Figure 3**) is located on the end of the carrier element 48 opposite the engagement section 52. A second ~~plugg [sic]~~plug element (not shown) is located in the printer, with which second plug element the first plug element forms an electrical plug connection when the carrier element 48 is completely inserted into the paper transport aggregate 18 (and this is, for its part, inserted into the printer).

[0028] The carrier element 48 and the blade-like contact element 34 are shown in an unassembled state in **Figure 4**. The blade-like contact element comprises an angle plate with a first section 60 and a second section 62 that, in the shown exemplary embodiment, form with one another an angle of approximately 90°. The second section 62 of the ~~Blade~~blade-like ~~[sic]~~ contact element 34 has two recurved sections 64. A rectangular gap 66 in the second section 62 is located between the recurved sections 64.

[0029] A film 68 made from polyimide is adhered with a conductive adhesive onto the first section 60 of the angle plate. The film 68 has a thickness of 75 µm. Via interspersed carbon black particles, its volume resistance is reduced to a value that is between $10^2$ and 109 Ωcm, preferably between 106 and 108 Ωcm. Its surface resistance is between $10^2$ and 1012 Ω/sq, preferably between 1010 and 1012 Ω/sq.

[0030] The carrier element 48 has an essentially V-shaped cross section that is formed from a floor area 70 and a back wall 72. Small blocks 74 are arranged on the floor area 70 that are separated from the back wall 72 and with this respectively form a groove 76. Such a groove 76 can be recognized particularly well in **Figure 5**, in which the carrier element 48 and the blade-like contact element 34 are shown from a different viewing angle. Pressure pins 78 that are pre-stressed against the back wall 72 are spring-borne in the small blocks 74. Finally, a web 80 that, together with the back wall 72, forms a further groove 82 is arranged on the floor area 70.

[0031] The groove 82 and the three grooves 76 form a recess into which the second section 62 of the blade-like contact element 34 can be inserted with positive fit. Both outer pressure pins 78 thereby press on the second section 62 of the blade-like contact element 34

and hold this in position. The center pressure pin 78 has a rounded tip and engages in the gap 66 in the second section 62 of the blade-like contact element 34, whereby it exerts pressure on the lower edge of the gap 66 in the representation of **Figure 4** and thereby exerts a force component on the blade-like contact element 34 that pushes this into the recess.

[0032] A notch 84 is located in the web 80, into which notch 84 a guide section 86 on the blade-like contact element 34 engages when it is inserted into the recess of the carrier element 48. The guide section 86 and the notch 84 thereby help to find the correct position upon insertion of the blade-like contact element 34 into the recess of the carrier element 48.

[0033] Upon insertion of the blade-like contact element 34 into or, respectively, upon extraction of the same from the recess of the carrier element 48, the blade-like contact element can be gripped at the recurved sections 64. The blade-like contact element 34 is an expendable part and can be easily exchanged in the manner specified here and without the assistance of tool [sic]. In particular the exchange of the ~~Blade~~blade-like ~~[sic]~~ contact element is made easier in that the carrier element can simply be extracted from and inserted back into the printer or copier (in the shown exemplary embodiment from the paper transport aggregate 18 of such a one).

[0034] Electrical contacts (not shown) that contact the second section 62 of the angle plate when this is inserted into the recess of the carrier plate 48 are located in the groove 82. A current flow from the plug element 58 over the angle plate and the film 68 onto the transport belt is ensured via these contacts.

[0035] Although a preferred exemplary embodiment is shown and described in detail in the drawings and in the preceding specification, this should be viewed as purely exemplary and not as limiting the invention. It is noted that only the preferred exemplary embodiment is shown and described, and all variations and further modifications that presently and in the future lie within the protective scope of the invention should be protected.

[0036] ~~Reference list~~

[0037]

~~10~~ ~~Photoconductor drum~~

~~12~~ ~~charge corotron~~

~~14~~ ~~character generator~~

~~16~~ ~~developing unit~~

~~18~~ ~~paper transport aggregate~~

~~20~~ ~~transport belt~~

~~22~~ ~~first roller~~

~~24~~ ~~second roller~~

~~26~~ ~~tension roller~~

~~28~~ ~~position roller~~

~~30~~ ~~rotation direction of the first roller~~

~~32~~ ~~device for electrical charging of the transport belt 20~~

~~34~~ ~~blade-like contact element~~

~~38~~ ~~abrasion ridge~~

~~40~~ ~~toner capture reservoir~~

~~42~~ ~~cleaning unit~~

~~44~~ ~~fixer unit~~

~~46~~ ~~paper sheet~~

~~48~~ ~~carrier element~~

~~50~~ ~~recess~~

~~52~~ ~~engagement section~~

~~54~~ ~~detent hook~~

~~55~~ ~~groove~~

~~56~~ ~~release button~~

~~58~~ ~~first plug element~~

~~60~~ ~~first section of the angle plate~~

~~62~~ ~~second section of the angle plate~~

| | | |
|---|---|---|
| | ~~64~~ | ~~recurved section~~ |
| | ~~66~~ | ~~gap~~ |
| | ~~68~~ | ~~plastic film~~ |
| | ~~70~~ | ~~floor area~~ |
| | ~~72~~ | ~~back wall~~ |
| | ~~74~~ | ~~small block~~ |
| | ~~76~~ | ~~groove~~ |
| | ~~78~~ | ~~pressure pin~~ |
| | ~~80~~ | ~~web~~ |
| | ~~82~~ | ~~groove~~ |
| | ~~84~~ | ~~notch~~ |
| | ~~86~~ | ~~guide section~~ |

~~Patent claims~~

~~1. Device (32) for electrical charging of a transport belt (20) for the transport of recording media (46) in the transfer printing region of an electrophotographic printer or copier,~~

~~in which a blade-like contact element (34) via which electrical charge is transferred to the transport belt (20) is arranged transverse to the running direction of the transport belt (20) and abutting on this,~~

~~and in which the blade-like contact element (34) is arranged on a carrier element (48) that can be inserted into the printer or copier and extracted from this.~~

~~2. Device (32) according to claim 1, in which catch means (54) are provided that engage when the carrier element (48) is completely inserted into the printer or copier.~~

~~3. Device (32) according to claim 1 or 2, in which a first plug element (58) is arranged on the carrier elements [sic] (48) or on the blade-like contact element (34), a second plug element is arranged in the printer or copier, and the first plug element and second plug element form with one another an electrical plug connection when the carrier element (48) is completely inserted into the printer or copier.~~

~~4. Device (32) according to any of the preceding claims, in which the carrier element (48) has a recess into which the blade-like contact element (34) (which is preferably attached to the carrier element (48) such that it can be detached) can be inserted with positive fit.~~

~~5. Device (32) according to claim 4, in which the recess comprises at least one groove (76, 82).~~

6. ~~Device (32) according to claim 4 or 5, in which the blade-like contact element (34) is retained in the recess by at least one spring-borne pressure pin (78) that is pre-stressed against the blade-like contact element (34).~~

7. ~~Device (32) according to claim 6, in which the blade-like contact element (34) has a gap (66) in which the pressure pin (78) engages when the blade-like contact element (34) is inserted into the recess of the carrier element (48).~~

8. ~~Device (32) according to any of the preceding claims, in which the blade-like contact element (34) comprises a plastic film (68) that produces the electrical contact with the transport band (20).~~

9. ~~Device (32) according to claim 8, in which the plastic film is comprised of polyimide.~~

10. ~~Device (32) according to claim 8 or 9, in which the electrical resistance of the plastic film (68) is reduced by interspersed carbon black particles.~~

11. ~~Device (32) according to claim 8 or 9, in which the electrical volume resistance of the plastic film (68) is between $10^2$ and $10^9$ Ωcm, preferably between $10^6$ and $10^8$ Ωcm.~~

12. ~~Device (32) according to any of the claims 8 through 11, in which the electrical surface resistance of the plastic film (68) is between $10^2$ and $10^{12}$ Ω/sq, preferably between $10^{10}$ and $10^{12}$ Ω/sq.~~

13. ~~Device (32) according to any of the claims 8 through 12, in which the thickness of the plastic film (68) is between 50 µm and 100 µm.~~

14. ~~Device (32) according to any of the claims 4 through 7 and any of the claims 8 through 13, in which the blade-like contact element (34) comprises an angle plate with a first section (60) and a second section (62) that together form an angle,~~

whereby the plastic film (68) is attached on the first section (60) and the second section (62) can be at least partially inserted into the recess of the carrier element (48).

15. Device (32) according to claim 14, in which the second section (62) has at least one recurved section (64) at which the blade-like contact element (34) can be gripped upon insertion into or, respectively, upon removal from the recess of the carrier element (48).

16. Device (32) according to claim 14 or 15, in which electrical contacts are arranged on the carrier element (48), which electrical contacts contact the angle plate when it is inserted into the recess of the carrier element (48).

17. Blade-like contact element (34) for charging of a transport belt (20) for the transport of recording media (46) in the transfer printing region of an electrophotographic printer or copier device,

with a first section (60) on which a plastic film (68) is attached, which first section (60) is suitable to produce an electrical contact with the transport belt (20),

and with a second section (62) for attachment of the blade-like contact element (34) to a carrier element (48) which can be inserted into the printer or copier.

18. Blade-like contact element (34) according to claim 17, in which the plastic film (68) is comprises of polyimide.

19. Blade-like contact element (34) according to claim 17 or 18, in which the electrical resistance of the plastic film (68) is reduced via interspersed carbon black particles.

20. Blade-like contact element (34) according to any of the claims 17 through 19, in which the volume resistance of the plastic film (68) is between $10^2$ and $10^9$ Ωcm, preferably between $10^6$ and $10^8$ Ωcm.

21. Blade-like contact element (34) according to any of the claims 17 through 20, in which the electrical surface resistance of the plastic film (68) is between $10^2$ and $10^{12}$ Ω/sq, preferably between $10^{10}$ and $10^{12}$ Ω/sq.

22. Blade-like contact element (34) according to any of the claims 17 through 21, in which the thickness of the plastic film (68) is between 50 µm and 100 µm.

23. Blade-like contact element (34) according to any of the claims 17 through 22, in which the first section (60) and a second section (62) are sections of an angle plate that together form an angle,

24. Blade-like contact element (34) according to claim 23, in which the second section (62) has at least one recurved section (64) at which the blade-like contact element (34) can be gripped upon insertion into or, respectively, upon removal from the recess of the carrier element (48).

25. Blade-like contact element according to any of the claims 17 through 24 that is fashioned for use in a device according to any of the claims 1 through 16.

26. Method for electrostatic charging of a transport belt (20) for the transport of recording media (46) in the transfer printing region (48) [sic] of an electrophotographic printer or copier,

in which the electrical charge is transferred to the transport belt (20) via a blade-like contact element (34) arranged transverse to the running direction of the transport belt (20) and abutting on this,

~~whereby the blade-like contact element is arranged on a carrier element (48) that can be inserted into the printer or copier and extracted from this.~~

~~27.~~ ~~Method according to claim 26, in which a first plug element (58) is arranged on the carrier element (48) or on the blade-like contact element (34), a second plug element is arranged in the printer or copier, and in which an electrical plug connection is formed by the first plug element and the second plug element when the carrier element (48) is completely inserted into the printer or copier.~~

~~28.~~ ~~Method according to claim 26 or 27, in which the carrier element (48) has a recess into which the blade-like contact element (34) can be inserted with positive fit.~~

~~29.~~ ~~Method according to claim 28, in which the recess comprises at least one groove (76, 82).~~

~~30.~~ ~~Method according to claim 28 or 29, in which the blade-like contact element (34) is retained in the recess by at least one spring-borne pressure pin (78) that is pre-stressed against the blade-like contact element (34).~~

~~31.~~ ~~Method according to any of the claims 26 through 30, in which the blade-like contact element (34) comprises a plastic film (68) (in particular a plastic film made from polyimide) that produces the electrical contact with the transport band.~~



**[0038]** Although other modifications and changes may be suggested by those skilled in the art, it is the intention of the inventors to embody within the patent warranted hereon all

changes and modifications as reasonably and properly come within the scope of their contribution to the art.

~~Translation / 18 May 2005 / Bullock / 4080 words~~

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